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PER-CASE REIMBURSEMENT FOR MEDICAL CARE

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PER-CASE REIMBURSEMENT FOR MEDICAL CARE

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ABSTRACT

An experimental program was established to test and evaluate the concept of reimbursing physicians for in-hospital medical care on a case basis, instead of the traditional disaggregated fee-for-service approach. Physician reimbursement amounts were based upon patients' discharge diagnoses, using a schedule of diagnosis categories based upon ICDA classifications. Primary research objectives were to test the effects of per case reimbursement upon inpatient hospital utilization, and to determine any associated changes in medical care costs. Comparisons with cross-sectional and longitudinal control groups indicate some modest favorable changes in average length-of-stay, with concomitant potential cost savings.

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I. INTRODUCTION

The Per-Case Reimbursement Project was an experimental program conducted by Pennsylvania Blue Shield (PBS) to test an alternative method of reimbursing physicians for in-hospital medical care services. Under the per-case reimbursement concept, the primary physician in charge of an inpatient medical case received a prospectively determined single payment for each case, with the amount of payment depending upon the reported discharge diagnosis.

The traditional and more commonly encountered method of reimbursing physicians for in-hospital medical care is on a disaggregated fee-for-service basis, with separate payment increments for each hospital visit, medical examination or other similar medical service provided by the attending physician. Since the physician's income under a fee-for-service arrangement depends upon the number of services rendered, there may appear to be some financial incentive for the physician to maximize the number of services delivered. This maximization incentive may be translated into an incentive to extend hospital stays -- or at least to forgo opportunities to reduce lengths of stay -- in order to increase the number of services delivered for any given episode of illness.

If it is true that physicians -- either consciously or unconsciously -- sense and respond to incentives such as those suggested above, it then should be possible to modify the hospital utilization behavior of physicians through an appropriate modification of these incentives. By paying the primary attending physician an equitable fixed payment allowance per case, considering only the disease entity treated and not the specific length of

treatment, it is hypothesized that the per-case reimbursement mechanism may operate upon the system of incentives in such a way as to lead to reductions in average length of stay. This in turn may create a potential for reducing total costs per case. The per-case reimbursement approach is quite simply an attempt to take advantage of the physician's natural desire to optimize the relationship between his work and his income, and place it within the framework of a reimbursement system that encourages shorter, rather than longer, lengths of stay. While the possibilities of such an approach often have been speculated upon, the per-case reimbursement concept for medical care has remained largely untested up to this point in time.

II. BACKGROUND ISSUES AND RELATED RESEARCH

Concern over problems inherent in the American health care system today pervade the literature. Fuchs (11) identifies three major problem areas as being:

(a) rapidly rising costs of medical care;

(b) lack of availability of services to certain segments of the population;

(c) the relatively unfavorable position of the United States reflected in health status indices, despite the large and rapidly increasing costs of care.

To a large extent, these three major problem areas certainly may be viewed as interrelated.

The problem of rapid cost increases is recognized by both consumers and providers. On the basis of surveys conducted in 1971 and 1972, Strickland (37) reports that three out of four American health system problems identified by the general public were in some way related to cost. Forty-nine percent of the physicians polled for this same study identified the high cost of medical care as America's number one health problem.

In terms of aggregate expenditures, Skolnick and Dales (35) report a total of $139.3 billion in fiscal year 1976 for the public and private sectors combined for health and medical care. This total represented a 14.0 percent increase from FY 1975 and constituted the greatest increase

since 1970 with the exception of the FY 1975 increase of 15.3 percent. These combined health expenditures totalled 8.6 percent of GNP, compared to 7.2 percent in 1970 and 5.9 percent in 1965. On a per capita basis, Petty (27) cites expenditures for personal health care amounting to $547 in 1975 compared to $78 in 1950. Inflation is identified as the cause of 44 percent of the increase from 1950 to 1965, and 53 percent of the increase from 1965 to 1975.

Rice and Wilson (31) isolate three components of increased cost as: price inflation, product change and increased utilization. Theories of sources of inflation are cited to include demand-pull from increased insurance coverage, labor cost-push, wasteful capital expenditures, and hospital inefficiency and cost-reimbursement. To these, McCarthy (21) adds lagging productivity and scientific/technologic progress.

Included as factors influencing the demand-pull aspect are increases in insurance coverage and increases in income. With increased third party involvement, Fuch notes that the demand for medical care becomes relatively inelastic with respect to price, thereby exerting a positive influence on consumption. The existence of this positive influence is further supported by Feldstein's empirical research (9) relating hospital coverage to patient days and hospital expenditures and by O'Donnell (23) in a discussion of overhospitalization. Given that this phenomenon exists, one can examine the mechanism from the standpoint of either the provider or the consumer of services. McCarthy addresses behavior on the part of each, noting that the physician, for instance, may be tempted to schedule an additional but not entirely necessary test; or the patient, as a precautionary measure, may elect to spend an extra day in the hospital if given a choice.

The physician's behavior stems from a number of well-acknowledged realities in our society. He is regarded as the dominant decision-maker in determining the patient's pattern of care and this, to a great extent, actually determines demand for services. He knows that, depending on the nature and extent of third-party coverage, he will be reimbursed for his services with little or no financial hardship on his patient (beyond the opportunity costs of loss of work and the cost of travel).

Ultimately, this must point to the question of suboptimal utilization as a significant factor in the increase in medical care costs (in conjunction with increased coverage under third party reimbursement mechanisms). The capital expenditure aspect of inflation frequently can be associated with gross examples of underutilization. For instance, McCarthy points out that of 770 hospitals equipped for open-heart surgery, 30 percent had no cases during the study year and 87 percent of those with cases averaged less than one operation per week.

The demand-pull aspect of inflation, however, more normally is associated with overutilization -- presumably due in large part to third party payment mechanisms and the nature of reimbursement inherent to those mechanisms. While reimbursement methods play a significant role in determining utilization, they must operate in conjunction with other conditions in order to exercise their maximum impact on utilization, particularly on inpatient hospital utilization.

Some of these conditions are illustrated in an article by van der Gaag et al. (39) in a study of hospital use in 120 service regions in the Netherlands between 1969 and 1971. The analysis calculated elasticity of admissions with respect to bed supply and supply of general practitioners

and substitutability of first level care for inpatient hospital care. The authors point out that, due to medical insurance, the demand for medical services on the part of the patient does not respond to price changes. Instead, the physician's role in determining the amount of care required suggests that demand more or less follows the supply of medical care. Admission rates, mean stay and patient days therefore are influenced largely by the supply of hospital beds.

In sum, the thrust of much of the current and recent literature is toward the notion of relationship between rising medical costs, the role of the physician in determining patterns of care, and the growth in third-party reimbursement mechanisms.

Physicians' fees typically are based on either a disaggregated UCR (usual, customary and reasonable) or a fee schedule method. The UCR method pays the physician an amount based upon the fee actually charged, his own usual fee, or the customary fee for his professional peers in the area in which he practices, whichever is lower. Under the fixed fee schedule method, the physician commonly may receive reimbursement ranging from 20 percent of his usual fee for a given procedure to over 100 percent.

Traditional reimbursement mechanisms lend little or no incentive to contain costs. Incentive reimbursement mechanisms have been developed, however, with varying degrees of success. McCarthy (20) points out that incentive experiments are not new, and that the incentive may be positive or negative, may be directed toward outcome or process, and may be oriented toward future or past performance. Most of the incentive systems attempted since the 1967 SSA amendments may be characterized as prospective, outcome-oriented, and generally positive in their emphasis.

In the context of hospital reimbursements, Prussin and Wood (29) discuss incentive reimbursement formulas based on average costs of comparable hospitals in a given region and based on average budgeted costs of those hospitals. The incentive, of course, would be a bonus for operating below average cost. The authors point out that incentive formulas for physicians are extremely uncommon, although there is no reason that they could not be developed to encourage appropriate utilization.

Dowling (5) points out that the problem with conventional (retrospective) reimbursement mechanisms is their lack of negative reinforcement for cost increases or incentives for cost containment. Dowling's observations are: (a) the more a hospital spends, the more it is paid; (b) the more efficient a hospital becomes, the less it gets paid; and (c) payers cannot determine a budget for health costs until after the fiscal year has ended.

In light of these problems with retrospective systems, it was hoped that appropriately designed prospective mechanisms might exert some positive influence on cost control. Dowling delineates six alternative payment bases which can be used in prospective rate setting, each with varying incentives aimed at hospital behavior: (a) apportionment of total budget, (b) apportionment of departmental budgets, (c) capitation, (d) case, (e) day, and (f) specific services. It is suggested that the per case reimbursement approach would "....motivate hospitals to admit more patients, but if possible to admit less complex case types, to shorten stays, and to reduce the intensity and scope of services provided." It is presumed that these effects would lower case costs.

According to Dowling, there currently are 26 prospective reimbursement systems in existence in 22 states, involving approximately 25 percent of

U. S. hospitals. However, there still appears to be a question as to their effectiveness in reducing costs. He points out the importance of the physician as a determinant of utilization and hence cost, and states that the exclusion of physicians diminishes the effectiveness of a prospective reimbursement plan. The primary benefit of prospective reimbursement, according to Dowling, has been to force planning, budgeting, and cost control improvements in the less efficient hospitals.

In another article, Dowling (6) reports results of the New York prospective reimbursement system in which per diem rates are established on the basis of previous years' costs and anticipated inflation. In general, findings of cost reduction were "suggestive, but not conclusive." Lengths of stay, while declining, did so more slowly than in control hospitals, admissions increased, and intensity of service increased more slowly. It was expected that the base year would penalize an efficient hospital due to its lower level of slack; however, the study was inconclusive as to the validity of this theory.

Any discussion of reimbursement mechanisms and their relationship to hospital and/or physician behavior should address itself to the wide variations in fee bases, in particular those of physicians, since they play such a critical role in determining utilization. Glaser (12) lists the typical bases for paying physicians -- ranging from "global" methods such as salary, through progressively disaggregated methods such as capitation, case payments, and fee-for-service arrangements. He discusses experiences with each, primarily in European countries. Although the conventional basis of reimbursement of U. S. physicians is fee-for-service, the results of European experiences and some experiments in the U. S. may hold implications

for changes in our own system.

Sloan and Steinwald (36) observe, as does Glaser, that a principal danger in both fee-for-service and case payment methods is that unnecessary procedures may be ordered in an effort to collect more money. It is suggested that this may present itself in forms ranging from excessive office visits and tests to unnecessary surgical procedures. This does not necessarily always entail questions of medical ethics in terms of potential physical harm that may be done to a patient. An example from the Swiss experience indicates that electrocardiograms (EKG), for instance, are a prime candidate for over-utilization, since they do not harm the patient and are reimbursed at a relatively lucrative rate.

If cost control is to be approached from the standpoint of incentive payments to physicians and/or hospitals, the desired end result should be a reduction in overutilization without sacrifice of quality. Evidence compiled thus far suggests that this may be accomplished through a shift in both physician and hospital reimbursement mechanisms so as to remove currently existing incentives encouraging excessive utilization of services. The results of such changes should be visible in reduced lengths of stay, and hence, reduced costs per case. This kind of incentive for reducing lengths of stay, and therefore cutting case costs, is illustrated in Glaser's example of Dutch surgeons who, upon receiving global fees for single procedures, may be "more eager to discharge an inpatient promptly in order to make room for a new patient." Again, however, one must recognize the hazardous potential for these incentives to go beyond the reduction of unnecessarily long stays, to the point of possibly inducing a certain number of excessively short stays.

A Social Security Administration report on a 1967 National Conference

on Medical Costs (22) expressed concern for the potential negative effects of such mechanisms on quality of care, and also noted the possibility that in the long run they may achieve little more than a mere shifting of costs. In addition, it should be recognized that, although a reduction in length of stay should lower per-case costs, there may be associated with this a counter tendency for inpatient per diem costs to rise, since the more expensive services normally are provided early in the patient's stay. This phenomenon has been noted by Berry (2) and others.

Finally, although the cost per episode may be lowered under these more global reimbursement mechanisms (primarily through reductions in overutilization), there still is no certainty that this would assure any long-run reduction in the total cost of medical care. This uncertainty arises from the fact that reductions in length of stay would immediately induce some additional, perhaps excess, capacity; and the manner in which any given hospital may react to this remains highly uncertain, although crucially important. While considerable variation could be expected among different hospitals, one can at least speculate on some of the possible responses. Dowling (5) anticipates that a shift to payment on a per case basis could bring the following responses:

(a) increases in efficiency and in numbers of cases treated;

(b) decreases in length of stay, complexity of case-mix, intensity of service, scope of service, amenity level, quality level, input prices, investment in resources, and teaching programs.

While certain responses may indeed be anticipated in the short-run in individual hospitals, given prior knowledge of factors such as hospital

occupancy rates and efficiency, it becomes increasingly difficult to predict long-run responses and demand pattern changes. Obviously, the complexity of hospital cost functions makes consistent and valid answers difficult to ascertain. Recent work by researchers such as Lave and Leinhardt (17) may begin to shed some light on the intricacies of the problem and provide a basis for further research into the area of cost relationships, particularly in relation to lengths of stay.

III. PBS PER-CASE REIMBURSEMENT PROGRAM

In 1972, a small cooperative project to test some of these concepts was conducted by Pennsylvania Blue Shield, Blue Cross of Northeastern Pennsylvania, and a single hospital located in northeastern Pennsylvania. Fifteen frequently occurring diagnoses were selected for inclusion in the program. A schedule of per-case payment allowances was developed, based upon PBS claims experience for these diagnoses. Five physicians on the hospital staff participated in the program and agreed to accept the per-case allowances as payment in full for cases involving medical care to Blue Cross/Blue Shield subscribers hospitalized at the participating institution for any of the selected conditions.

This initial exploratory program ran for a period of one year. The results were encouraging, indicating substantial reductions in length of stay for diabetes mellitus and certain categories of heart patients. The findings were far from conclusive, however, due to the small samples imposed by the deliberately limited size and scope of the experiment. To provide a more extensive test of the per-case reimbursement concept, an expanded program was undertaken including a larger number of hospitals, physicians and diagnoses.

The first stage of this expansion was implemented in January, 1974. Thirty-seven diagnosis categories were included; hospital participation was broadened to five non-proprietary, non-teaching institutions; and fifty-two physicians participated, representing approximately half of the combined medical staffs of the participating hospitals.

In July, 1975, with the assistance of a federal research grant from the Health Resources Administration, U. S. Department of Health, Education, and Welfare, the experimental program in the field was extended for a period of one additional year and concurrently was expanded to include a still larger number of hospitals and physicians. This report addresses that stage of the experimental program growing out of this most recent expansion.

DESCRIPTION OF THE EXPERIMENTAL PROGRAM

The experimental Per-Case Reimbursement (PCR) program operating in the field during the period July 1, 1975 through June 30, 1976, included a total of ten participating hospitals. One of these was the site of the original experimental program in 1972; and because of its prior involvement, this hospital's experience data was excluded from the data base used in evaluating effects observed in the expanded PCR program. The remaining nine hospitals potentially useful for evaluational purposes in the expanded program were dispersed throughout various parts of the state. Two were in the Greater Philadelphia area; three were in other eastern Pennsylvania locations; one was located in the central part of the state; and three were located in western Pennsylvania. The participating hospitals were of small-to-medium size, averaging 212 beds throughout the period 1973-1975. The smallest had 108 beds in 1973, and the largest had 330 beds in 1975. These hospitals had an average daily census of 158 inpatients from 1973 through 1975, with a mean occupancy rate of 73.8 percent. The participating institutions provided a reasonably representative cross-section of non-proprietary, non-teaching hospitals in Pennsylvania, in which physicians tend to practice singly rather than in teams. Conscious effort was made to exclude teaching hospitals and

hospitals offering high levels of specialized services, since these might be expected to present relatively larger proportions of unusual and complicated cases, with corresponding differences in treatment modalities.

Ninety-one physicians on the staffs on these nine hospitals agreed to participate in the program and accept scheduled PCR allowances as payment in full for qualifying Blue Cross/Blue Shield patients treated by them at any of the participating institutions. However, only sixty-one of these doctors actually participated by sending in claims under the program. These actively participating doctors included thirty-five primary care physicians -- mainly general practitioners and family practice physicians, but also including two pediatricians. The remaining twenty-six were specialists, principally in internal medicine, cardiology and urology. Although specialists comprised only 43 percent of the actively participating doctors, they were far more productive in submitting claims under the PCR program. On the average, each participating specialist contributed nearly twice as many PCR claims as were contributed by individual participating primary care physicians. Physician participation was entirely voluntary. Although it may be argued that a population of physicians enlisted on this basis is not necessarily representative of physicians in general, the voluntary participation basis had to be accepted as a necessary condition for any study of this sort to be conducted, since Blue Shield has no effective means by which to assure the cooperation of particular physicians as part of a designed test population.

Concurrent with the July, 1975 expansion, the list of covered medical conditions also was revised. Analysis of performance and experience data from previous stages of the experiment suggested that certain diagnosis categories be consolidated or eliminated. These changes, along with a small

number of new additions, provided a list of twenty-four disease classifications to be included in this stage of the program. The design objectives here were simply to establish a set of classifications in which each class would be well-defined, in which the specific disease entities included within any given class would be reasonably similar and/or homogeneous, and in which cases might be expected to occur with sufficient frequency to provide adequate sample sizes. The included disease categories, with corresponding ICDA codes, are listed below:

DIAGNOSIS/DISEASE CATEGORY	ICDA-8	H-ICDA
Arterial Embolism and Thrombosis, gangrene	444.0-445.9	444.0-445.9
Arteriosclerosis	440.0-440.9	440.0-440.9
Arthritis and Rheumatism	710.0-718.0	710.0-718.0
Asthma	493.0	493.0, 493.9
Bronchitis and bronchiolitis, acute	466.0	489.0, 489.1
Bronchitis, chronic and unqualified	490.0-491.0	490.0-491.2
Cerebrovascular disease	430.0-438.9	430.0-438.9
Cystitis	595.0	595.0-595.9
Diabetes Mellitus	250.0-250.9	250.0-250.7
Disease of Thyroid gland	240.0-246.0	240.0-246.0
Emphysema	492.0	492.0
Gastric, Duodenal and Gastrojejunal ulcer	531.0-534.9	531.0-534.3
Gastritis and Duodenitis	535.0	535.0
Gastroenteritis	009.2	009.2
Hypertension, Essential or Malignant	400.0,401.0	400.0, 401.0

DIAGNOSIS/DISEASE CATEGORY	ICDA-8	H-ICDA
Infections of the Kidney	590.0, 590.1	590.0, 590.2
Ischemic Heart Disease, Acute	410.0-410.9	410.0-410.9
Ischemic Heart Disease, subacute, chronic and asymptomatic; Angina Pectoris	411.0-414.9	411.0-414.0
Pneumonia	480.0-486.0	480.0-486.0
Pulmonary Embolism and Infarction	450.0	450.0
Rheumatic Heart Disease, chronic	393.0-398.0	393.0-398.0
Symptomatic Heart Disease	427.0-428.0	415.0-416.9 425.2-425.9 427.0-427.9
Thrombophlebitis	451.0-451.9	451.0-451.9
Upper Respiratory Infection, acute	460.0-465.0	460.0-465.0

Recommended payment allowances were developed for each of the above categories by bringing together data and information on average length of stay for given diagnoses from HUP and PAS reports, typical patterns of physician services reflected in PBS claims experience, and applicable medical price information from PBS data bases. Reflecting the tendency of specialized practitioners to charge at rates different from primary care practitioners, two different payment schedules were developed: one for general, family and pediatric practitioners and another for internists, cardiologists and urologists. The physicians who had agreed to participate then were given an opportunity to review the proposed payment amounts, at which point a few minor changes were negotiated. Finally, the proposed schedule was reviewed by Pennsylvania Blue Shield Medical Advisors. This process produced a schedule of payment allowances both acceptable to the participating physicians and generally

representative of a fair market value for each of the covered medical services. To avoid the idiosyncracies that could develop if physicians were allowed to make supplemental billings to patients covered under this program, participating physicians were required to accept the finally established payment levels as payment in full for services delivered under the PCR program.

The following is a summary of conditions that had to be satisfied for claims to be eligible for payment under the terms of this experimental program:

(a) The patient had to be a Blue Shield subscriber with coverage for in-hospital medical care benefits;

(b) The patient was required to be a medical inpatient at one of the participating hospitals, with a participating doctor serving as the physician primarily in charge of his case;

(c) Hospital admission must have occurred between the dates of July 1, 1975 and June 30, 1976, inclusive;

(d) The patient's discharge diagnosis must have been one of those previously defined as included in the PCR program;

(e) Cases involving definitive surgery during the same hospital stay were not eligible for PCR payment, since such surgery would introduce complicating factors that could tend to bias the length-of-stay statistics;

(f) The patient must have been under 65 years of age, since elderly patients may have substantially different length-of-stay characteristics for any given disease entity;

(g) Cases with length-of-stay less than two days, or more than 60 days were excluded;

(h) Medically indigent patients, covered under medical assistance (Medicaid) were excluded;

(i) The patient must have been discharged live with the approval of the attending physician, and must not have simply been transferred to another facility.

With the exception of designed variations in items (a) and (c), these conditions also constituted the criteria used in defining control groups used for purposes of comparative evaluation.

RESEARCH OBJECTIVES AND DESIGN

The primary objectives of the research and evaluation component of this project were: (1) to obtain quantitative measures of any differences or changes in length of stay (LOS) that may be attributable to the per-case method of reimbursement; and (2) to examine the cost implications of any observed variations in length of stay.

Essentially, the experimental design involved four comparative experience groups as outlined below, where Group 1 is the experimental group, Group 2 is a cross-sectional comparison group, and Groups 3 and 4 are longitudinal reference groups for Groups 1 and 2, respectively:

	Experimental Time Period (July 1975 - June 1976)	Pre-Experimental Time Period (1973)
Blue Cross/Blue Shield Patients	Group 1	Group 3
Cross-sectional Comparison Population	Group 2	Group 4

Group 1 consisted of cases with patients having Blue Cross/Blue Shield coverage and satisfying all of the qualifying criteria described earlier for eligibility in the experimental program.

Group 2 consisted of cases with patients satisfying exactly the same selection criteria as Group 1, except that they did not have their costs covered by Blue Cross/Blue Shield. As such, these cases were not handled under the per-case method of physician reimbursement, but otherwise constituted a very similar population. These are cases in which the patients were treated for the same range of conditions, by the same doctors, in the same hospitals, during the same period of time as the experimental population.

Groups 3 and 4 are like Groups 1 and 2, respectively, except that they represent experience for comparable groups prior to the initiation of the per-case reimbursement experiment. These are cases involving patients treated for the same range of conditions, by the same doctors, and in the same hospitals as Groups 1 and 2, but at an earlier time.

Data for the experimental population (Group 1) were extracted from PCR claim forms submitted to Blue Shield by participating physicians. Data for cross-sectional and longitudinal comparison groups were extracted from Hospital Utilization Program (HUP) and Professional Activity Study (PAS) records to which the participating hospitals had granted access. Data for all four groups were collected and maintained in such manner as to permit stratification by diagnosis categories, by specific participating hospitals and/or physicians, by type of physician provider, and by various patient characteristics.

To provide an independent baseline of experience for comparative and evaluative purposes, data were collected for four additional experience groups analogous to Groups 1 through 4 defined above, but involving only

cases treated by non-participating doctors. The experience of the non-participating doctors, however, was found to be either generally sparse or not very consistently concentrated in the same diagnosis categories as that of the participating doctors. Because of the resulting difficulty in obtaining meaningful matches between the experience bases of participating and non-participating doctors, the usefulness of these particular intergroup comparisons was extremely limited, and they were not used in the final analysis.

Average LOS was computed for each design group, for each diagnosis category at each hospital. Changes or differences in LOS were measured and expressed in terms of simple arithmetic differences between average LOS for corresponding cells in different groups. Since length-of-stay data distributions tend to be markedly non-Gaussian, non-parametric statistical methods were used to determine the significance of observed differences. The analysis focused principally upon measurement of longitudinal changes in LOS occurring between the experimental group and its historical antecedent (Group 3 to Group 1), and upon the comparison of these changes with corresponding changes in the cross-sectional control groups (Group 4 to Group 2).

Cost implications were studied by comparing actual Blue Cross and Blue Shield payments for cases handled under PCR to the payment levels that might have been expected for these same cases if the PCR program had not intervened. Methods used for comparative cost analysis are described later in somewhat greater detail.

IV. EXPERIMENTAL FINDINGS

Experience data, as indicated in the preceding discussion of research design, were gathered for inpatient medical cases in four experimental design groups defined as follows:

Group 1 -- PCR experimental population;

Group 2 -- Cross-sectional comparison (control) group;

Group 3 -- Experience from longitudinal base period for Group 1;

Group 4 -- Experience from longitudinal base period for Group 2.

Total numbers of case observations captured for each design group were:

Group 1 -- 1,467 cases;

Group 2 -- 1,441 cases;

Group 3 -- 1,394 cases;

Group 4 -- 1,582 cases.

Data for each design group were organized and maintained within the conceptual framework of a 24 X 9 matrix representing the case experience in each diagnosis category at each participating hospital. Thus, while the aggregate numbers of cases reported above may appear initially to constitute a respectably large sample of experience, it can be seen that the sampling is in fact quite thin when distributed over all 216 of the possible hospital/diagnosis combinations defined by this experience matrix. Well over half of the hospital/diagnosis combinations had extremely small samples; and every hospital had at least a few diagnosis categories in which there was no observed experience.

The general paucity of experience data in both the experimental and control groups dictated some compromise with conventional standards for minimum sample size. Within each design group, a minimum of six observations in a given diagnosis category at a given hospital was taken as a sufficiently large sample to provide an acceptable level of reliability and validity in mean LOS statistics. These very small samples were warranted not only by necessity, but also were justified to some extent by the fact that in most instances they did not have inordinately large variances. Intergroup comparisons for any given hospital/diagnosis combination of course required that the minimum sample size be satisfied across all design groups. Data contained in experience cells for which adequate matching data cells could not be obtained were discarded.

A summary of the observed incidence and average lengths of stay in all four design groups for all hospital/diagnosis combinations having at least six observations in both Group 1 and Group 3 is found in Appendix A. Blank spaces in the Group 2 and Group 4 columns indicate hospital/diagnosis combinations for which fewer than six cases were captured in at least one of these two cross-sectional groups. It may be noted that only eight hospitals are represented in Appendix Table A-1. The one hospital not represented there had no diagnosis categories for which at least six cases occurred in both Group 1 and Group 3.

LENGTH OF STAY CHANGES

A total of forty-five hospital/diagnosis combinations satisfied the requirement for at least six observations in all four blocks of the design. Longitudinal changes in average LOS were computed for these forty-five cases

and are displayed in Table 1. The figures in the "Experimental Population" column are the differences between Group 3 and Group 1 LOS averages; those in the "Cross-section Population" column are the corresponding LOS differences between Group 4 and Group 2. Decreases in mean LOS from 1973 to the experimental time period are indicated by negative values in the table. Values flagged with an asterisk (*) represent LOS changes found to be statistically significant at the 0.10 level, using the Kruskal-Wallis test.

A favorable outcome, as reflected in the data contained in Table 1, may be defined as one in which the experimental group difference in average LOS is more negative (or less positive) than the corresponding cross-sectional group change. Approximately half of the LOS changes detailed at the hospital/diagnosis level were by this definition favorable, and half unfavorable, thereby presenting a set of experimental results on which a clear and unambiguous interpretation is, at best, difficult. If, however, one looks only at those hospital/diagnosis combinations for which at least one of the columns shows a statistically significant change, the outcome becomes slightly more definitive. Within this more narrowly limited set of experimental outcomes, a total of nine were favorable, four were unfavorable, and one was for all practical purposes indecisive.

Closer examination of the comparative results listed in Table 1 begins to reveal some striking differentials in experimental outcome at different hospital sites. Hospitals A and C, for example, show predominately favorable results, while hospital D shows predominately unfavorable results. The variation in PCR effectiveness at different hospitals is more readily apparent in the listing of aggregate LOS changes for each hospital site, as shown in Table 2. When aggregated by hospital, these data quickly reveal

TABLE 1. LONGITUDINAL CHANGES IN LENGTH OF STAY FOR EXPERIMENTAL AND CROSS-SECTIONAL POPULATIONS

(Change from 1973 to experimental period, 7/75-6/76;
N $\geq$ 6 in all design groups, 1 through 4)

HOSPITAL/DIAGNOSIS CATEGORY	LOS Change (Days)*	
	Experimental Population	Cross-Section Population
HOSPITAL A		
Asthma	-5.4 *	-3.5 *
Bronchitis and Broncheolitis: Acute	+0.3	+0.4
Diabetes Mellitus	+0.5	+0.1
Ulcer: Gastric, Duodenal, etc.	-1.8 *	-1.9 *
Gastritis and Duodenitis	-1.2 *	0.0
Gastroenteritis	-0.8	-0.1
Ischemic Heart Disease: Acute	-2.5	+0.8
Ischemic Heart Disease: Subacute, etc.	-1.0	-0.7
Pneumonia	-0.2	0.0
Symptomatic Heart Disease	+1.5	+0.4
Thrombophlebitis	-4.3 *	-0.5
Upper Respiratory Infection	+0.6	+0.5
HOSPITAL B		
Gastroenteritis	+0.6	-0.2
Ischemic Heart Disease: Acute	-1.5 *	+3.6
Ischemic Heart Disease: Subacute, etc.	+1.1	-0.3
HOSPITAL C		
Bronchitis and Broncheolitis: Acute	-1.7	-3.2
Ulcer: Gastric, Duodenal, etc.	-2.0 *	-1.8
Ischemic Heart Disease: Acute	-2.8 *	+0.6
Ischemic Heart Disease: Subacute, etc.	-0.2	+0.1
Pneumonia	-2.0	+1.2
Symptomatic Heart Disease	-0.7	+3.2
(Table continued on next page.)		

* Indicates LOS change is statistically significant at the .10 level.

TABLE 1. (CONTINUED)

HOSPITAL/DIAGNOSIS CATEGORY	LOS Change (Days)*	
	Experimental Population	Cross-Section Population
HOSPITAL D		
Bronchitis: Chronic/Unqualified	+0.7	-1.1
Cerebrovascular Disease	-4.0	-7.8
Diabetes Mellitus	-5.1 *	-1.0
Gastroenteritis	-0.6	-0.8 *
Hypertension	+5.3	-1.0
Ischemic Heart Disease: Acute	+1.2	-2.0
Ischemic Heart Disease: Subacute, etc.	-2.5	-0.7
Pneumonia	+0.4	-0.7 *
Symptomatic Heart Disease	-0.8	-2.4
Upper Respiratory Infection	+0.2	+0.1
HOSPITAL E		
Bronchitis and Broncheolitis: Acute	-1.3	-2.0 *
Gastroenteritis	+0.7	-1.4 *
Ischemic Heart Disease: Subacute, etc.	+0.3	0.0
Pneumonia	-0.4	+3.6
HOSPITAL F		
Pneumonia	+0.8	+0.2
HOSPITAL G		
Asthma	+0.5	+0.2
Bronchitis and Broncheolitis: Acute	-1.1	+0.2
Bronchitis: Chronic/Unqualified	-0.5	-1.0
Diabetes Mellitus	+1.6	0.0
Gastroenteritis	-0.6	+0.2
Hypertension	-4.0 *	+1.6
Ischemic Heart Disease: Acute	-0.9	+3.0 *
Ischemic Heart Disease: Subacute, etc.	+0.2	-0.1
Pneumonia	+1.2	-0.1

*Indicates LOS change is statistically significant at the .10 level.

TABLE 2. AVERAGE CHANGE IN LENGTH OF STAY, BY HOSPITAL

For all Hospital/Diagnosis combinations with N ≥ 6 in Groups 1-4

Hospital	Number of Diagnosis Categories Represented	LOS Change from 1973 to 7/75-6/76 Period			
		Experimental Population		Cross-Section Population	
		Days	% Change	Days	% Change
A	12	-1.6	-19%	-0.4	- 5%
B	3	-3.1	-28	+0.2	+ 2
C	6	-1.9	-24	-0.8	+10
D	10	-0.1	- 1	-0.8	-11
E	4	+0.1	+ 2	+1.3	+20
F	1	+0.9	+14	+0.2	+ 3
G	9	+0.3	+ 4	+0.6	+ 3
OVERALL	15	-0.2	- 3%	0.0	0%

that the PCR program apparently was highly effective at hospitals A, B, C and E ("effective" at hospital E in the sense that the mean LOS increase here for the experimental population was not nearly so great as for the control population). At hospitals D and F the aggregate outcome was more favorable to the control group, although the result from site F perhaps should be largely discounted, since it represents a total of only ten cases, all in the same diagnosis. The remaining hospital, G, exhibits only marginal difference between experimental and control population results.

In sum, Table 2 shows net LOS changes -- i.e., differences between experimental and cross-sectional group changes -- favorable to the PCR group at four of the experimental sites (A, B, C and E), with net advantages for the PCR group ranging from 14 percent to 30 percent; shows a net 10 percent advantage for the control group at one site (D); and shows only negligible difference between the experimental and control groups at one other site (G). The outcome for site F is not included here as a stand-alone result, since it was obtained from such an extremely small experience base. Overall, the aggregate result from all seven hospital sites taken together indicates a net three percent reduction in average length of stay for the PCR group.

The percent of change in LOS shown in Table 2 for the experimental population provides an obvious and convenient measure of PCR program effectiveness. If the seven hospitals listed here are ranked on this PCR effectiveness criterion, and then also are ranked from lowest to highest on their 1973 occupancy rates, the respective rankings are:

Hospital	Effectiveness Ranking	Ranking on 1973 Occupancy
A	3	1
B	1	2
C	2	3
D	4	5
E	5	4
F	7	7
G	6	6

Using the Spearman rank correlation test to make a direct comparison between these two sets of rankings, a rho value of 0.857 is obtained, indicating correlation at the 0.05 significance level. The strong correlation obtained here means that PCR apparently is most effective in reducing LOS at hospitals with lower *a priori* occupancy rates. This in general supports a hypothesis that hospitals with low occupancy rates may seek to maintain higher occupancy by tolerating some slack in their lengths of stay; and that PCR then is effective principally in reducing this slack to whatever degree it exists.

PCR effectiveness in reducing average length of stay also seems to vary quite greatly from one diagnosis category to another, but valid and useful generalizations are much less evident on this point. A reexamination of the LOS changes listed in Table 1 reveals no diagnosis classification, other than acute ischemic heart disease, for which PCR net effectiveness appears to be either consistently good or consistently bad across all hospitals. For acute ischemic heart disease, the results obtained at various hospitals appear to be rather consistently favorable to the PCR experimental group.

It also is enlightening to reexamine the complete set of average length-of-stay data given in Appendix A, in comparison with corresponding length of stay norms listed in Appendix B for PAS hospitals in the northeastern United States. The LOS averages observed for each of the participating hospitals are uniformly lower than the northeastern norms. This is true for both the experimental time period and the longitudinal base period. In light of the fact that all of the participating hospitals already were achieving relatively short lengths of stay, it is perhaps all the more remarkable that PCR had the effectiveness it apparently did in reducing still further the average length of stay at more than half of the participating institutions.

Finally, since the same doctors were treating both experimental and control group patients, it could be conjectured that some of the effects of the experimental group treatment might carry over into the treatment of the cross-sectional population -- the so-called Hawthorne effect. Although this could reasonably be anticipated, no evidence was found of significant correlation between effects observed in the experimental group and effects observed in the cross-sectional group.

COST ANALYSIS

An estimate of the cost implications of PCR was obtained by comparing actual and expected Blue Cross/Blue Shield payments for the forty-five hospital/diagnosis combinations identified earlier as satisfying minimum data sample requirements across all four design groups.

A key problem here is to determine what the experimental group (Group 1) length of stay might have been if PCR had not been introduced. One way of making this determination is to assume that, without PCR, the

Group 3 LOS change from 1973 to the experimental time period would have been proportional to, and in the same direction as, the LOS change observed from Group 4 to Group 2 over the same span of time. For computational purposes, this can be expressed as:

$$\text{Expected } \overline{\text{LOS}}_1 = \overline{\text{LOS}}_3 \left[1 + \left(\frac{\overline{\text{LOS}}_2 - \overline{\text{LOS}}_4}{\overline{\text{LOS}}_4} \right) \right]$$

where $\overline{\text{LOS}}_i$ is the mean length of stay for any given hospital/diagnosis combination in group i.

Expected Blue Cross and Blue Shield payment amounts for each hospital/ diagnosis combination were calculated as the product of the Group 1 incidence, times the expected Group 1 LOS, determined as above, times applicable per-diem rates for both Blue Cross and Blue Shield. The per-diem rates used for this purpose were specific to each hospital, diagnosis category, and expected LOS. These per-diem rates were developed through the application of regression techniques to empirical data representing cases in each required hospital/diagnosis combination.

Expected payments developed in this fashion and summarized by hospital are displayed in Table 3, along with the corresponding data representing actual payments made by Blue Cross and Blue Shield for cases handled under the PCR program. Differences between these actual and expected payments are displayed in Table 4, which presents them as gains or losses associated with the PCR program. (The difference is said to be a "gain" if the PCR actual payment is less than the expected payment.) Again, the data are summarized by hospital, representing aggregate results at each hospital over all diagnosis categories having adequate sample sizes in all four design groups.

TABLE 3. SUMMARY OF ACTUAL AND EXPECTED PAYMENTS, BY HOSPITAL

For all Hospital/Diagnosis Combinations with N $\geq$ 6 in Groups 1 through 4

HOSPITAL	ACTUAL PAYMENTS			EXPECTED PAYMENTS		
	Blue Shield	Blue Cross	Total	Blue Shield	Blue Cross	Total
A	$24,085	$143,070	$167,155	$23,255	$152,343	$175,568
B	9,947	85,120	95,067	8,612	91,534	100,146
C	7,848	68,898	76,746	7,754	70,367	78,121
D	16,266	159,090	175,356	15,989	146,906	162,895
E	8,583	63,958	72,541	7,782	61,139	68,921
F	1,006	7,494	8,500	868	6,753	7,621
G	11,196	122,714	133,910	13,893	128,711	142,604
TOTAL	$78,931	$650,344	$729,275	$78,123	$657,753	$735,876

TABLE 4. SUMMARY OF DIFFERENCES BETWEEN ACTUAL AND EXPECTED PAYMENTS, BY HOSPITAL

For Hospital/Diagnosis Combinations with N ≥ 6 in Groups 1 through 4

HOSPITAL	EXPERIMENTAL CASES REPRESENTED	GAIN (LOSS) FOR PROGRAM			GAIN (LOSS) AS PERCENT OF EXPECTED PAYMENT			AVERAGE GAIN (LOSS) PER CASE
		Blue Shield	Blue Cross	BC/BS Combined	Blue Shield	Blue Cross	BC/BS Combined	
A	249	($ 860)	$ 9,273	$ 8,413	(3.7)	6.1%	4.8%	$33.79
B	82	(1,335)	6,414	5,079	(15.5)	7.0	5.1	61.93
C	82	(94)	1,469	1,375	(1.2)	2.1	1.8	16.77
D	176	(277)	(12,184)	(12,461)	(1.7)	(8.3)	(7.6)	(70.80)
E	92	(801)	(2,819)	(3,620)	(10.3)	(4.6)	(5.3)	(39.35)
F	10	(138)	(741)	(879)	(15.9)	(11.0)	(11.5)	(87.90)
G	144	2,697	5,997	8,694	19.3	4.7	6.1	60.38
TOTAL	835	($ 808)	$7,409	$6,601	(1.0%)	1.1%	0.9%	$ 7.91

The bottom line on Table 4 shows that, for the aggregate of all 835 experimental cases occurring in the forty-five hospital/diagnosis combinations included in the analysis, Blue Shield paid out a total of $808 more than otherwise might have been expected for the same mix of cases if the PCR program had not intervened. Blue Cross, on the other hand, paid out $7,409 less than might have been expected for these same cases. The exchange ratio was approximately $9 of Blue Cross gain against every dollar of Blue Shield loss, for a combined Blue Cross/Blue Shield gain of approximately one percent on the expected payout. I.e., actual total payments made by Blue Cross and Blue Shield combined were one percent less than the expected combined total payments. The average gain per case was approximately $8.

These relatively modest bottom line results may be somewhat misleading, however. As was observed when looking at the LOS statistics, there are vast differences in PCR performance and effectiveness from one individual hospital to another. Clearly, some very nice gains were realized at some of these hospitals. Hospitals A, B and G, for example, showed overall net gains in the neighborhood of five and six percent of expected payout, with average gains per case ranging up to nearly $62. These gains were offset by substantial losses at other experimental sites -- particularly at hospital D, which alone showed a combined Blue Cross/Blue Shield loss of more than $12,000.

Table 5 represents comparative cost data from still another perspective, summarizing actual and expected payments by diagnosis category. It can be seen that the largest gains per case were made in cases of acute ischemic heart disease and thrombophlebitis, although the latter is based

TABLE 5. SUMMARY OF ACTUAL AND EXPECTED PAYMENTS,

BY DIAGNOSIS CATEGORY

For Hospital/Diagnosis Combinations with N ≥ 6 in Groups 1 through 4

DIAGNOSIS CATEGORY	EXPERIMENTAL CASES REPRESENTED	COMBINED BC/BS PAYMENTS			GAIN(LOSS) AS % OF EXPECTED	GAIN (LOSS) PER CASE
		Actual	Expected	Net Gain (Loss)		
Asthma	16	$ 9,775	$ 9,864	$ 89	0.9%	$ 5.56
Bronchitis & Broncheolitis: Acute	58	30,577	28,010	2,567	9.2	44.26
Bronchitis: Chronic/Unqualified	22	19,031	15,251	(3,780)	(24.8)	(171.82)
Cerebrovascular Disease	9	8,745	6,169	(2,576)	(41.8)	(286.22)
Diabetes Mellitus	83	64,735	73,855	(9,120)	12.3	109.88
Ulcer: Gastric, Duodenal, etc.	41	20,820	20,778	(42)	(0.2)	(1.02)
Gastritis and Duodenal	15	8,178	9,543	1,365	14.3	91.00
Gastroenteritis	119	60,246	52,310	7,936	15.2	66.69
Hypertension	13	12,017	12,832	815	6.4	62.69
Ischemic Heart Disease: Acute	79	152,063	173,675	21,612	12.4	273.57
Ischemic Heart Disease: Subacute, etc.	195	190,226	181,488	(8,738)	(4.8)	(44.81)
Pneumonia	127	104,453	101,324	(3,129)	(3.1)	(24.64)
Symptomatic Heart Disease	23	20,957	21,250	293	1.4	12.74
Thrombophlebitis	16	13,422	17,674	4,252	24.1	265.75
Upper Respiratory Infection	19	12,041	11,854	(187)	(1.6)	(9.84)
TOTAL	$835	$729,275	$735,876	$ 6,601	0.9%	$ 7.91

upon a relatively small experience sample. Good gains, along with good sample sizes, also can be seen for acute bronchitis, diabetes mellitus and gastroenteritis. Very substantial losses, on the other hand, are associated with chronic/unqualified bronchitis and cerebrovascular disease categories. A fairly substantial average loss per case, along with a very significant sample size, also is associated with subacute and chronic varieties of ischemic heart disease. While these diagnosis-based cost figures are interesting to look at, one should be very cautious about attempting to draw any generalizations from the data in Table 5. These generalizations probably would be highly suspect, since there is considerable variation in both the incidence of particular disease entities and the performance of the PCR mechanism from one hospital to another. At hospital D, for instance, a net gain was associated with the subacute and chronic ischemic heart disease category, while diabetes mellitus sustained a net loss -- both contrary to the tendencies exhibited at most other hospital sites.

CONCURRENT CHANGES IN ADMISSION RATES

Consistent with effects that have been observed or suggested in a number of other studies, it should be suspected that one might find increases in the number of admissions to compensate for decreases in average length of stay. For the forty-five hospital/diagnosis combinations forming the core of experience upon which this analysis has been based, the finding is contrary to that expectation. While the experimental group showed an aggregate length of stay reduction of 2.6 percent, and the cross-sectional group showed no change in aggregate length of stay, the corresponding admissions statistics for these same forty-five hospital/diagnosis combinations

showed declines of 5.3 percent and 4.2 percent, respectively. The experimental group showed a total utilization decline of 12.9 percent fewer patient-days from the base period to the experimental time period. The cross-sectional group experienced a decline of 3.7 percent in total patient-days during the same time span. It must be acknowledged, of course, that these figures reflect only a portion of the total experience at each participating hospital.

One of the concerns expressed in relation to this kind of incentive program is that some unknown number of the short stays occurring within the framework of the experiment may not in fact be reduced longer stays, but rather may be short-stay admissions that otherwise might have been ambulatory and outpatient. If this were indeed the case, it would be reflected in increased admissions. Thus, the possibility that such a conversion of outpatient days to short inpatient stays may have occurred in connection with this PCR experiment is in effect refuted by the declining admissions statistics cited above.

The potential for conversion of outpatient days to short inpatient stays also was expressly monitored during the course of the experimental program by examining the number of admissions in each diagnosis category to determine the variance in admission rates between the experimental and longitudinal base periods. Calculation of the average number of cases per month in each diagnosis category revealed that there were no tendencies for participating physicians to significantly increase admission rates during the experimental time period for any one diagnosis. These findings were supported by parallel analyses examining longitudinal changes in admission rates for individual doctors.

QUALITY OF CARE

There also was concern for the possibility that creation of incentives for reducing length of stay might in some cases lead to premature or early discharges detrimental to the patient's well-being. The PCR program included features designed to detect this phenomenon if it occurred.

The first of these protective measures was a post-discharge patient survey. Blue Shield subscribers receiving inpatient medical care under the PCR program were mailed questionnaires designed to provide information on their perception of the quality of care received. Since participating doctors were expected to accept the PCR allowance as full payment, the questionnaire also inquired as to any supplemental billing the patients may have received. The response rate on this questionnaire mailing was approximately two-thirds. The responses received showed a rather strong endorsement of the quality of care received, as perceived by the respondents. Ninety-nine percent reported that the care received was satisfactory, and 96 percent expressed the opinion that their length of stay was neither too short nor too long. Although the patient himself is not necessarily a qualified judge on these questions, it was felt that the survey procedure at least provided a vehicle through which there would be an opportunity for gross abuses to be reported. In the few cases where dissatisfaction was indicated, a careful follow-up study of the reasons for these reported dissatisfactions showed that none of them stemmed from factors uniquely related to the PCR program *per se*.

A second approach to monitoring quality of care delivered under the PCR program involved a comprehensive study of hospital re-admission rates. It was assumed that a high incidence of re-admissions for the same medical

conditions might be indicative of inadequate treatment (including the possibility of premature discharge) at the time of the original episode of hospitalization. Blue Shield history files were searched to identify and develop further information on PCR patients who were readmitted for inpatient treatment with the same or a related diagnosis within six months of discharge from an inpatient stay handled under the PCR program. This investigation revealed that 11.8 percent of the patients treated within the framework of the PCR program returned as an inpatient within six months with the same medical problem, compared to a re-admission rate of 16.0 percent for Pennsylvania Blue Shield medical inpatients not handled under the PCR program. This clearly indicates that there was no abnormal or excessive rate of hospital re-admission for cases handled under the PCR program.

V. CONCLUSIONS AND DISCUSSION

Results obtained from the PCR experimental program provide reasonably conclusive evidence that the case method of reimbursement can be effective in promoting shorter lengths of stay for inpatient medical cases. The effectiveness of this method of reimbursement varies quite significantly, however, from one hospital to another.

To obtain the true measure of the experimental program's effectiveness at any given hospital, the observed LOS change for the experimental group should be adjusted by subtracting from it the corresponding control group change, which may be taken as a reflection of the ambient background trend in LOS at that hospital. Using this concept of an adjusted, or "net," LOS change, four of the seven hospitals that could be evaluated showed net changes favorable to the PCR experimental group; two showed net changes more favorable to the control group, but one of these had an extremely small base of experience and should perhaps be disregarded; and one showed no substantial difference between experimental and control group changes. Net reductions in average length of stay at sites more favorable to the PCR group ranged as high as 30 percent.

In general, the PCR method of reimbursement can be expected to result in higher levels of Blue Shield payout to physicians. This incremental Blue Shield payout was found to be as high as 16 percent of the "expected" payout at two of the experimental sites. It is important to note, however, that this does not mean the physicians are in effect being granted a price increase for services delivered to PCR patients. The incremental Blue

Shield payout more correctly should be seen as the difference between a "full payment" plan and Blue Shield's normal reimbursement schedules (which frequently provide less than full payment). It represents that portion of the physician's total charge that otherwise would be an out-of-pocket expense for the patient, if it is paid at all. Thus, the incentive for the physician is perhaps not so much a matter of additional payment, as it is the prospect of a guaranteed payment -- a known, predictable amount that he perceives as fair and equitable, which always will be paid in full. Since the physician's payment under PCR is based upon expected lengths of stay, he of course also has the added incentive of receiving the same pay for less work if the average length of stay for his PCR patients is reduced to something less than the expected LOS.

At those hospitals where an LOS reduction is achieved and is greater than the reduction that might otherwise have been expected on the basis of prevailing LOS trends, the increased Blue Shield payment to physicians will always be more than offset by reduced Blue Cross payments to the hospitals. This favorable trade-off is assured by the simple fact that an inpatient hospital day costs considerably more than does a physician's hospital visit; and the difference between these two cost components becomes the dollar value of each day of hospital utilization saved. At the experimental sites for which these favorable conditions were realized, the trade-off of Blue Cross "savings" against Blue Shield "losses" ranged from a ratio of 5:1 up to a ratio of 16:1. The potential saving in combined Blue Cross and Blue Shield payments at these favorable sites most commonly was in the neighborhood of five percent, relative to expected payout.

Negative outcomes of one sort or another were experienced at three of the experimental hospital sites, viz., the hospitals identified as D, E

and F. In examining the possible reasons for these negative results, hospital F can be dismissed immediately on the basis of inadequate sample size. The outcome observed at this hospital was based upon a total of only ten cases, all in a single diagnosis category, and therefore was not necessarily statistically representative. With its scant experience base of only ten cases, the experience at hospital F in fact could not have had very much impact on the aggregate outcome observed for all seven hospitals combined.

Hospital E presents an interesting phenomenon, in that the average length of stay here increased for both the experimental and control populations, inevitably leading to an adverse financial outcome. The encouraging thing about hospital E is that the increase in average LOS for the experimental group here was considerably smaller than for the control group. The case reimbursement method at this hospital can in fact be termed a qualified success, in the sense that it apparently made a bad situation less bad than it otherwise might have been for the PCR experimental population.

The greatest concern focuses on hospital D, since the results obtained here were overwhelmingly adverse. Of all seven hospitals evaluated, this one had the second largest experience base, thereby making it highly unlikely that the negative result obtained here was merely a statistical aberration. Nevertheless, the response of this one hospital to PCR was almost pathological, being so distinctly different from the response at most other hospitals. Further investigation revealed that this particular hospital underwent a sizable expansion between 1973 and 1975; and it can only be conjectured that this may have contributed some enormous pressures to maintain the occupancy rate, thereby creating a significant counteraction

to the PCR incentives. The phenomenology of a hospital's response to PCR under such circumstances is very poorly understood.

Unfortunately, hospital D contributed such a large base of experience that its impact on the overall outcome for the combination of all seven hospitals was quite significant. As shown in the bottom line of Table 4 (page 32), the aggregate financial outcome for all seven hospitals was an increased Blue Shield payout of 1.0 percent, against a Blue Cross saving of 1.1 percent, for a net aggregate saving of 0.9 percent. If the data from hospital D are deleted from the aggregate experience, the bottom line is a Blue Shield loss of 0.9 percent, with a Blue Cross gain of 3.8 percent, and a net overall saving of 3.3 percent. With hospital D omitted, the bottom line in Table 2 (page 26) would show an overall reduction of 10 percent in average length of stay for the experimental group, compared to an aggregate reduction of four percent for the control group.

Irrespective of how these isolated negative outcomes may be rationalized, the significant fact remains that different hospitals may show vastly different responses to the per-case reimbursement mechanism. The reasons for these differences in response to PCR are not entirely clear. One of the more significant findings from this study, however, is that these differences in response to PCR can be at least partially explained by the hospitals' *a priori* occupancy rates. It has been clearly demonstrated that the case reimbursement method is more effective in achieving and/or maintaining lower average lengths of stay at hospitals with lower occupancy rates. The conclusion to be drawn from this is that hospitals with lower occupancy rates tend to have more slack in their average lengths of stay, and that the per-case reimbursement method is effective primarily in

reducing this slack, to whatever extent it may exist.

Apart from the potential cost savings that might be associated with reduced lengths of stay under PCR, there are other advantages to the case reimbursement method that should be mentioned here at least briefly, even though they were not specifically addressed in the study. One of these is the potential for simplifying the reporting of inpatient medical care claims. Essentially, this could be reduced to a single line item on a claim form, as opposed to the relatively more complicated multiple service, multiple line item claims usually required in connection with a disaggregated fee-for-service approach. The simplification in preparation and subsequent handling of claim forms would have obvious advantages for doctors, their office assistants, and those carrier personnel involved in the processing and payment of claims. Although no definitive operational cost studies have been performed, claims processing experts at Pennsylvania Blue Shield tend to believe that the processing of medical care claims would be less expensive under a PCR system.

There are some significant practical problems, as well as potential advantages, with PCR; and these also should be at least briefly discussed. For example, it is questionable whether it would ever be possible to handle _all_ medical care claims by the PCR method. This arises from the reality that a certain number of diagnoses are not very well defined; a number of other diagnoses, although perhaps well enough defined, admit great variability in the range of accepted treatment patterns; there commonly are episodes of illness involving multiple diagnoses; and cases often arise in which no definitive diagnosis can be made. In light of these practical limitations, it is apparent that PCR methods could be applied only to a limited finite

subset of all the possible illness conditions that might be reported on claims for payment. Those not manageable within the framework of the PCR approach would have to be handled in some other way, quite possibly by reverting to the traditional fee-for-service approach. A parallel in-house study of some of the practical feasibility issues involved in the implementation of PCR has suggested that under ideal conditions a PCR system might readily be applied to as many as 60 percent of all inpatient medical claims, possibly more. Under less than ideal conditions, on the other hand, the relative number of inpatient medical claims that could be accomodated under the PCR approach might be as few as 15 percent. In any event, it seems almost certain that there always will be some residual number of claims that cannot be well adapted to handling by this method, and which would have to be given special handling.

If these observations are accurate -- and they probably are -- then any operational PCR system that could be installed would in fact have to be a dual system: part PCR, part fee-for-service. This development, unfortunately, would tend to negate the previously mentioned advantages. The anticipated advantages, in fact, not only would disappear; they probably would be turned completely around. PCR, introduced operationally only as an adjunct to currently existing systems, would only serve to increase the confusion in claim reporting procedures; and moreover, would very likely increase the complexity and cost of claims processing.

Other problems arise from the fact that PCR would have to operate as a full payment program -- i.e., a program in which participating physicians would be required to accept the PCR allowance as payment in full for all services delivered under the program. The necessity for this full payment

feature arises from the fact that PCR payment allowances are based upon expected lengths of stay; and if the physician sees a typical mix of both long and short cases, he will sometimes be overpaid and sometimes be underpaid, but in the long run should come out more-or-less even. If the physician ever were allowed to make supplemental billings in addition to the PCR allowances, the burden of additional payment most certainly would be very inequitably distributed among his patients -- most likely being concentrated in those unlucky enough to have longer than average stays. The problem is that full payment programs have to be paid for somehow; and the premium rates required in order to support this would be higher -- perhaps considerably higher -- than the rates for corresponding current Blue Shield programs. In the commercial market, these rates quite possibly would not be competitive and would encounter some serious marketing problems. For government funded programs, they would increase the tax burden. In addition, it is not at all clear how this kind of payment mechanism would work with non-participating doctors who are under no obligation to honor Blue Shield payments as payment in full.

There also is the question of physician acceptance of a PCR payment mechanism. Many doctors simply do not like this kind of approach as a basis of payment for their services. In a random survey of Pennsylvania doctors, it was found that 34 percent of the respondents reacted favorably to the PCR concept, 43 percent objected to it, and 23 percent were noncommittal. Many objected to the use of discharge diagnosis as a basis for reimbursement, while others feared that PCR would lead to standardization of care and loss of patient individuality. Physician response was much more favorable, however, among those who had actually tried PCR by participating in the

experimental program. In a separate survey of physicians participating in the PCR experiment, 89 percent indicated that they were satisfied with this method of reimbursement, and 94 percent said they would accept it as a permanent method.

Finally, there is the crucial problem of how to translate the potential savings made possible by reduced average lengths of stay into demonstrable actual savings. It must be recognized that the selective reductions identified in the PCR experimental program represent nothing more than a latent potential for cost savings. If hospitals do not take advantage of this potential, either through increased productivity or through the economies of closing unneeded beds and related facilities, the net effect of reduced LOS is simply a higher unit cost. The ultimate benefits of reduction in hospital utilization can be realized only if institutions are willing to take the hard steps necessary to turn potential economies into real dollars and cents saved.

In summary, PCR works -- at least in terms of its potential for reducing average lengths of stay for inpatient medical cases in environments where considerable slack exists. A number of outstanding problems remain to be solved, however, before PCR is sufficiently well understood to permit movement toward operational implementation. Some of the principal objectives that might be addressed in an agenda for further research are:

(a) better understanding of the factors and conditions that make PCR more effective at some hospitals than at others;

(b) better understanding of the relative responsiveness of different diagnoses to the PCR mechanism;

(c) extension of the PCR concept to ambulatory settings;

(d) broadening of the PCR concept to provide a global reimbursement covering a package of services other than simply examinations and visits by the primary attending physician -- e.g., lab tests, diagnostic x-rays, and diagnostic medical services;

(e) solutions to any or all of the "practical" problems discussed in this section.

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APPENDIX A

OBSERVED INCIDENCE AND AVERAGE LENGTH OF STAY FOR PCR EXPERIMENTAL AND CONTROL GROUPS

TABLE A-1. OBSERVED INCIDENCE AND AVERAGE LENGTH OF STAY

For Hospital/Diagnosis Combinations with N ≥ 6 for Both Group 1 and Group 3

(Blank spaces in Group 2 and Group 4 columns indicate hospital/diagnosis combinations for which fewer than six observations occurred in at least one of these cross-section groups.)

HOSPITAL/DIAGNOSIS CATEGORY	N/ $\overline{\text{LOS}}$ (Days)			
	Experimental Population		Cross-Section Population	
	7/75-6/76 (Group 1)	1973 (Group 3)	7/75-6/76 (Group 2)	1973 (Group 4)
HOSPITAL A				
Asthma	8/ 3.8	8/ 9.1	8/ 2.9	6/ 6.3
Bronchitis and Broncheolitis: Acute	15/ 5.1	7/ 4.9	13/ 4.2	8/ 3.9
Bronchitis: Chronic/Unqualified	9/ 5.2	8/ 7.4	---	---
Diabetes Mellitus	40/ 7.0	23/ 6.5	23/ 9.1	16/ 9.0
Ulcer: Gastric, Duodenal, etc.	25/ 4.9	25/ 6.7	12/ 4.5	20/ 6.4
Gastritis and Duodenitis	15/ 3.7	8/ 5.1	21/ 5.0	6/ 5.2
Gastroenteritis	40/ 4.4	14/ 5.3	11/ 4.4	14/ 4.5
Hypertension	13/ 5.2	16/ 6.7	---	---
Ischemic Heart Disease: Acute	10/ 14.6	21/ 17.1	12/ 17.3	16/ 16.4
Ischemic Heart Disease: Subacute, etc.	34/ 8.0	55/ 9.1	14/ 7.3	31/ 8.0
Pneumonia	34/ 7.9	36/ 8.1	26/ 7.9	20/ 7.9
Symptomatic Heart Disease	6/ 11.3	11/ 9.8	14/ 7.0	10/ 6.6
Thrombophlebitis	16/ 8.6	6/ 12.8	13/ 8.8	8/ 9.4
Upper Respiratory Infection	6/ 5.3	15/ 4.7	7/ 5.1	13/ 4.6
HOSPITAL B				
Gastroenteritis	30/ 4.3	6/ 3.7	17/ 3.9	7/ 4.1
Ischemic Heart Disease: Acute	17/ 15.6	13/ 17.1	13/ 16.1	9/ 12.4
Ischemic Heart Disease: Subacute, etc.	35/ 7.5	7/ 6.4	30/ 9.4	9/ 9.7
HOSPITAL C				
Bronchitis and Broncheolitis: Acute	12/ 4.8	9/ 6.6	12/ 4.8	11/ 7.9
Ulcer: Gastric, Duodenal, etc.	16/ 4.2	6/ 6.2	24/ 4.9	14/ 6.6
Gastroenteritis	19/ 3.2	14/ 4.6	---	---
Hypertension	6/ 13.3	8/ 4.9	---	---
Ischemic Heart Disease: Acute	13/ 12.0	17/ 14.8	10/ 13.3	22/ 12.7

(table continued)

TABLE A-1. (CONTINUED)

HOSPITAL/DIAGNOSIS CATEGORY	N/ $\overline{\text{LOS}}$ (Days)			
	Experimental Population		Cross-Section Population	
	7/75-6/76 (Group 1)	1973 (Group 3)	7/75-6/76 (Group 2)	1973 (Group 4)
HOSPITAL C (Continued)				
Ischemic Heart Disease: Subacute, etc.	25/ 5.9	17/ 6.1	28/ 6.4	18/ 6.3
Pneumonia	8/ 5.1	31/ 7.1	21/ 8.7	25/ 7.5
Symptomatic Heart Disease	8/ 4.6	8/ 5.4	14/ 11.6	16/ 8.4
HOSPITAL D				
Arthritis and Rheumatism	6/ 6.0	12/ 8.8	---	---
Asthma	7/ 4.6	11/ 5.8	---	---
Bronchitis: Chronic/Unqualified	16/ 7.6	16/ 6.9	29/ 6.2	26/ 7.3
Cerebrovascular Disease	9/ 7.2	12/ 11.3	16/ 6.4	9/ 14.2
Diabetes Mellitus	29/ 5.7	31/ 10.7	22/ 6.7	25/ 7.8
Gastritis and Duodenitis	9/ 4.4	12/ 4.4	---	---
Gastroenteritis	24/ 4.7	34/ 4.1	28/ 3.9	43/ 4.7
Hypertension	6/ 10.7	6/ 5.3	12/ 4.6	14/ 5.6
Ischemic Heart Disease: Acute	25/ 15.2	15/ 14.0	24/ 12.3	17/ 14.4
Ischemic Heart Disease: Subacute, etc.	18/ 6.2	46/ 8.8	20/ 9.0	27/ 9.7
Pneumonia	27/ 7.0	33/ 6.5	49/ 6.0	52/ 6.7
Symptomatic Heart Disease	9/ 6.0	16/ 6.8	9/ 5.4	14/ 7.9
Upper Respiratory Infection	13/ 5.0	35/ 4.8	31/ 5.0	46/ 4.9
HOSPITAL E				
Bronchitis and Broncheolitis: Acute	24/ 4.7	28/ 6.0	7/ 3.7	29/ 5.7
Bronchitis: Chronic/Unqualified	8/ 4.5	11/ 5.5	---	---
Diabetes Mellitus	7/ 7.0	9/ 6.8	---	---
Gastroenteritis	17/ 4.5	26/ 3.8	9/ 3.4	36/ 4.9
Ischemic Heart Disease: Acute	6/ 15.2	10/ 22.7	---	---
Ischemic Heart Disease: Subacute, etc.	28/ 7.9	13/ 7.6	22/ 9.0	20/ 9.0
Pneumonia	23/ 6.1	53/ 6.5	14/ 10.6	34/ 7.1
Upper Respiratory Infection	6/ 3.7	17/ 4.4	---	---
(table continued)				

TABLE A-1. (CONTINUED)

HOSPITAL/DIAGNOSIS CATEGORY	N/ $\overline{\text{LOS}}$ (Days)			
	Experimental Population		Cross-Section Population	
	7/75-6/76 (Group 1)	1973 (Group 3)	7/75-6/76 (Group 2)	1973 (Group 4)
HOSPITAL F				
Diabetes Mellitus	10/ 7.0	6/ 7.3	---	---
Ischemic Heart Disease: Subacute, etc.	9/ 6.1	7/ 8.3	---	---
Pneumonia	10/ 7.2	20/ 6.3	14/ 6.9	9/ 6.7
HOSPITAL G				
Asthma	8/ 6.3	18/ 5.7	16/ 4.7	15/ 4.5
Bronchitis and Broncheolitis: Acute	7/ 3.7	13/ 4.8	14/ 4.3	17/ 4.1
Bronchitis: Chronic/Unqualified	6/ 3.8	6/ 4.3	7/ 3.4	15/ 4.5
Diabetes Mellitus	14/ 7.8	12/ 6.2	36/ 7.1	22/ 7.1
Gastroenteritis	8/ 2.6	9/ 3.2	24/ 3.5	19/ 3.3
Hypertension	7/ 4.0	7/ 8.0	13/ 7.4	11/ 5.8
Ischemic Heart Disease: Acute	14/ 17.9	17/ 18.8	29/ 19.6	26/ 16.6
Ischemic Heart Disease: Subacute, etc.	55/ 7.4	22/ 7.3	88/ 6.4	62/ 6.5
Pneumonia	25/ 5.1	38/ 3.9	55/ 4.5	71/ 4.5
HOSPITAL H				
Diabetes Mellitus	7/ 6.9	8/ 7.6	---	---
Ischemic Heart Disease: Acute	19/ 17.6	15/ 18.6	---	---
Ischemic Heart Disease: Subacute, etc.	50/ 9.2	31/ 9.1	---	---
Pneumonia	11/ 7.0	43/ 9.0	---	---
Symptomatic Heart Disease	10/ 8.3	10/ 5.7	---	---

APPENDIX B

PAS LENGTH OF STAY NORMS

The following (Table B-1) are PAS norms on length of stay for selected diagnosis groupings that should be generally comparable with the diagnosis categories defined for purposes of this PCR study. Sources for data listed below are:

> Length of Stay in PAS Hospitals, United States, Eastern Region, 1973, Commission on Professional and Hospital Activities, Ann Arbor, Michigan, November 1974; and
>
> Length of Stay in PAS Hospitals, by Diagnosis, United States, Northeastern Region, 1975, Commission on Professional and Hospital Activities, Ann Arbor, Michigan, September 1976.

Both sources present norms for the region consisting of Pennsylvania, New Jersey, New York and the New England states. The statistics extracted for best comparability with PCR experience data were the subtotal data listed as "not operated," including both single and multiple diagnosis. In certain instances, PCR diagnosis categories have been defined so as to encompass two or more PAS diagnosis groups; and in those cases, the data listed in the following table are weighted averages of the length of stay data for all included PAS diagnosis groups.

TABLE B-1. PAS LENGTH OF STAY NORMS
FOR SELECTED DIAGNOSIS CATEGORIES

PCR DIAGNOSIS CATEGORY	CORRESPONDING PAS DIAGNOSIS GROUP(S)	PAS AVERAGE LOS (DAYS)	
		1973	1975
Arthritis and Rheumatism	256,257,258	11.3	11.0
Asthma	161	7.2	6.8
Bronchitis and Broncheolitis: Acute	158	6.8	6.8
Bronchitis: Acute/Unqualified	159	7.3	7.7
Diabetes Mellitus	67,68,69	11.0	10.6
Ulcer: Gastric, Duodenal, Gastrojejunal	172,173,174, 175	9.2	8.9
Gastritis and Duodenitis	176	6.2	6.1
Gastroenteritis	1	5.4	5.2
Hypertension	129	8.8	8.9
Ischemic Heart Disease: Acute	130	20.3	18.8
Ischemic Heart Disease: Subacute, Chronic and Asymptomatic; Angina Pectoris	131,132	11.7	10.7
Pneumonia	157	9.6	9.3
Symptomatic Heart Disease	133,135	11.7	11.0
Thrombophlebitis	149	12.4	12.0
Upper Respiratory Infection	155	4.7	4.5

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